REMARKS

Status of this application

In the Office Action mailed June 19, 2003, claims 1-32 were rejected in view of Hayka et al. Patent 5,688,118. Claims 1, 3, 6, 9, 0, and 12-13 were rejected under 35 U.S.C. §102(b) as being anticipated, and claims 2-4, 7-8 and 14 were rejected under 35 U.S.C. §103(a) in view of Hayka et al. The remaining claims were rejected under 35 U.S.C. §103(a) in view of the Hayka et al. Patent when considered in view of an article entitled "Virtual Teeth for Endodontics Training and Practice" by Arnold et al.

This response amends independent claims 1 and 19 (and the remaining claims that are dependent thereon) more clearly set forth applicants' invention. Claims 2-6 and 10 have been amended to refer to proper antecedents in amended claim 1. Claim 12 has amended to correct the identification of its parent claim. Claim 14 has been amended to correct a spelling error. Claims 21 and 24 have been amended to more clearly define the subject matter claimed.

Reconsideration of the rejections under Sections §102(b) and §103(a) is requested for the reasons set forth below.

The Section 102 Rejections based On Hayka et al 5,688,118

The cited Hayka et al. Patent 5,688,118 describes an arrangement for sensing the position of an actual dental drill [54] as it moves relative to an artificial tooth [58]. The compressed air flow rate which determines the speed at which the dental drill operates is controlled to provide the user with the sound and hand-feeling that would be experienced when drilling through tooth layers of different hardness.

In contrast, applicants' invention as claimed employs a digital computer coupled to a force feedback stylus and to a display that provides a visual model of a dental tool and a tooth. A haptic interface device as set forth in the amended independent claims 1 and 19 includes a force-feedback stylus that is manually moveable by a dental student and is coupled to said digital computer to move the displayed model of a dental tool with respect to the displayed model of a tooth. The computer calculates and applies interaction forces to the force-feedback stylus to simulate the feel of the dental tool and thereby haptically simulate a dental procedure .

The Hayka et al. Patent describes a system in which the student uses a conventional dental drill to work on an artificial tooth. A position sensor [62] is connected to the dental drill handpiece [52] to feed position data to a computer [70] which controls the flow of compressed gas from a compressed gas unit [76] to the handpiece, thereby varying the speed of the drill to simulate different layers of tooth hardness. The Hayka et al. Patent thus describes a system that uses an actual drill and not use a haptic interface device including a force-feedback stylus to which a digital computer applies calculated interaction forces to simulate the feel of a modeled dental tool. Claims 1-6, 10 and 19 have been amended by this response to more clearly set forth this important distinction between applicant's invention as claimed and the dental training system taught by the Hayka et al. Patent. Reconsideration of the rejection of Claims 1, 3, 6, 9, 0, and 12-13 based on the Hayka et al. Patent is accordingly requested.

It is noted that claim 3 further clarifies the fact that the handle of the dental drill is different from the force-feedback stylus which simulates the handle of the drill. In the Hayka et al. system, the actual drill is held by the student, rather than using a force-feedback stylus as claimed to simulate the drill.

Dependent claim 6 states that the dental tool whose handle is simulated by the force feedback stylus is selected by the dental student from a plurality of available tools. The cited passage at column 12, lines 34-40 of the Hayka et al. Patent does indicate that the student may use different kinds of tools to work on the artificial tooth (e.g. a chisel, an angle former, an enamel hatchet, etc.) and that the "actual work" can be displayed and observed on the screen. Like the Hayka et al dental drill, none of these other actual dental tools can be said to be a "force feedback stylus" and the Hayka et al. digital computer does not calculate and apply interaction forces to a force-feedback stylus to simulate the feel of any of these dental tools as claimed.

The Examiner suggested, with respect to claim 9, that the Hayka et al. Patent discloses a stereoscopic three dimensional display at column 8, lines 5-6. Reconsideration is requested since the cited passage merely states that the position sensor that is used to specify the position of the hand held dental tool in three dimensional space may take a variety of forms. Hayka et al. do not describe displaying a model of the tooth and the tool on a stereoscopic 3D display as claimed.

The Obviousness Rejection based on Hayka et al.

Claims 2-4, 7-8 and 14 were rejected under 35 U.S.C. §103(a) in view of Hayka et al. The Examiner conceded that Hayka et al. do not disclose the use of a pick, amalgam carrier or carver, but indicates that Hayka et al. do teach that their method may be used to enable a dental trainee to perform all variations of all dental procedures. As noted above with respect to claim 6, however, Hayka et al. disclose the use of actual tools rather than a haptic interface device that includes a force feedback stylus and a computer for calculating and applying interaction forces to the force feedback stylus. If the Hayka et al. procedure were extended to use a pick, amalgam carrier and/or stylus, one skilled in the art would connect a position sensor to these actual tools, devices, just as a position sensor is connected to the handle of Hayka et al. actual dental drill, and the tools would be used to work on a physical artificial tooth. The connected sensor would be used to provide tool position data used to display a model of the tooth and drill, but there is no suggestion in Hayka et al. that the student would hold a force feedback stylus of a haptic interface instead of these actual tools, and no suggestion that the sensed data would be processed by the computer to calculate and apply interaction forces to the force feedback stylus. Reconsideration of the rejection of claims 2-4, 7-8 and 14 is accordingly requested.

The Obvious Rejection based on Hayka et al.
in combination with the Arnold et al. Paper

The Examiner rejected claims 11, 15-18, and 19-32 under 35 U.S.C. §103(a) in view of the Hayka et al. patent considered in combination with a paper entitled "Virtual teeth for endodontics training and practice" by Arnold et al. (hereinafter "the Arnold paper).

In the Notice of References Cited, it is indicated that the Arnold paper was presented on July 19-20, 2000. While the Arnold et al. paper was presented prior to the October 3, 2000 filing date of the provisional application upon which the present application is based, applicants do not concede that it is in fact prior art and reserve the right to submit a declaration under Rule 131 to establish their earlier date of invention under Section 102(a) should that become appropriate. For the reasons presented in the remarks that follow, however, reconsideration of the rejection of claims 11, 15-18, and 19-32 based on the Hayka et al. patent in view of the Arnold paper is requested since the combination proposed by the Examiner does not remedy the deficiencies of the Hayka et al. teaching to yield the claimed combination.

With respect to claims 11, 15-18 and 19-32, the Examiner suggests that Hayka et al. disclose all of the claimed subject matter with exception of not explicitly disclosing that the model of the tooth is volumetrically rendered. The Examiner suggested that it would have been obvious to a person of ordinary skill in the art to modify the rendering of the tooth model as described in the Hayka et al. patent by providing volumetric rendering, in light of the teaching of Arnold et al., to provide a higher quality image.

As pointed out in the foregoing remarks, however, Hayka et al describes a system in which a computer display allows the student to view a model of the tool and tooth on the screen as the work is going on, but does not describe the use of a digital computer to calculate and apply interaction forces to the force-feedback stylus as claimed by applicants. Accordingly, it is submitted that the proposed modification to the Hayka et al. display to volumetrically render the tooth model on the display screen would not yield the invention set forth in the claims as amended.

More specifically, claim 19 as now amended, recites the use of a simulation program executable by a processor in response to the movement of a hand held force-feedback stylus for applying interaction forces to the force-feedback stylus to simulate the feel of a dental tool. In the Hayka et al. device, the student holds an actual dental tool rather than a haptic interface including a force feedback stylus to which interaction forces are applied to simulate the feel of an actual dental tool. Claim 19 further defines the storage of tool definition data for representing the shape and character of the modification region of a dental tool in three dimensional space. Hayka et al. describes the use of data that describes the position and orientation of the "drilling end" of the tool (column 10, line 64), but nowhere suggests that data is stored that defines the "shape and character" of a "modification region" as claimed.

Claim 21 has been amended by this response to state that the claimed system stores additional tool definition data that specifies the shape of a handle portion of the dental tool and the location of that handle portion relative to the modification region of said dental tool.

Claims 22-32, all of which are dependent upon and include the limitations of claim 21 as amended, further define the nature and/or use of the tool definition data. The Examiner has suggested that Hayka et al. disclose the use of "feel points" for controlling haptic forces applied to the handle at column 10, lines 60-67; however, that passage says nothing about feel points nor does it describe the calculation and application of haptic forces, but rather deals solely with the

manner in which the simulation is displayed on the monitor. The cited passage at column 9, lines 10-15 cited with respect to claim 25 merely states that a sensor is attached to the actual dental tool manipulated by the student, and does not suggest that the stored tool definition data specifies the location of feel point the define the location of the handle portion of the tool as claimed.

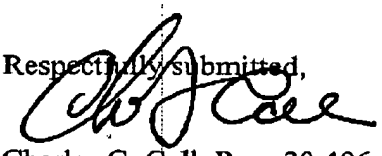
The Examiner further cites column 2, line 62 and column 3, line 12 with respect to the recitation in claim 26 that the feel points are located outwardly from the modification region to increase the amount of force a student must apply to modify the data representing the tooth, and in claim 27 that the feel points are located inwardly into the modification region to decrease the amount of force the student must apply. Neither cited passage in the Hayka et al. Patent discloses feel points, or their relative placement with respect to the modification region, to establish the amount of force the student must apply to the force feedback stylus. Indeed, since Hayka et al. do not use a force feedback stylus, but rather an actual drill, there is no control of any kind on the amount of force the student must apply.

The Examiner has stated that Hayka et al. discloses the subject matter set forth in claims 28-32, but cites no teaching which would justify that assertion. Applicant submits that the specific mechanisms recited for using feel points and sensor points set forth in claims 28-32 is not taught by the Hayka et al. reference, and reconsideration of these rejections is accordingly requested.

Conclusion

Allowance of claims 1-32 in view of the foregoing amendments and remarks is respectfully requested.

Respectfully submitted,



Dated: December 19, 2003

Charles G. Call, Reg. 20,406

Certificate of Transmission under 37 CFR 1.8

I hereby certify that this *Amendment, together with the accompanying request for an extension of time to respond,* is being transmitted by facsimile to (703) 872-9306 on December 19, 2003.

Dated: December 19, 2003 Signature _____

Charles G. Call, Reg. No. 20,406
USPTO Customer No. 021253
68 Horse Pond Road
West Yarmouth, MA 02673
Ph. (508) 778-2630 Fax (508) 629-6540
call@patentsoft.com